# Open Design at the Intersection of Making and Manufacturing

**David Philip Green** [1]
**Verena Fuchsberger** [2]
**David Kirk** [1]
**Nick Taylor** [3]
**David Chatting** [4]
**Janis Meissner** [4]
**Martin Murer** [2]
**Manfred Tscheligi** [2]
**Silvia Lindtner** [5]
**Pernille Bjorn** [6]
**Andreas Reiter** [7]

[1] Northumbria University, Newcastle, UK.

[2] Center for HCI, University of Salzburg, Austria.

[3] University of Dundee, Dundee, UK.

[4] Open Lab, Newcastle University, Newcastle, UK.

[5] University of Michigan, Michigan, USA.

[6] University of Copenhagen, Copenhagen, Denmark.

[7] University of Nottingham, Nottingham, UK.


*CHI'17 Extended Abstracts*, May 06-11, 2017, Denver, CO, USA
ACM 978-1-4503-4656-6/17/05.
http://dx.doi.org/10.1145/3027063.3027087

## Abstract
This one-day workshop aims to consider the opportunities for HCI at the intersection of maker culture and professional, industrial manufacturing. In particular, we are interested in exploring how the concept of *open design* could help support productive interactions between professional *manufacturers* and non-professional *makers*. Our proposal builds on momentum established by previous related workshops (including one at CHI2016) and aims to respond critically to several industry and government reports published in 2015-2016 on the 'maker movement'.

## Author Keywords
DIY; Making; Manufacturing; Open Design; Maker Culture; Fab Labs; IoT; Personal Fabrication; Industrial Production.

## ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous;

## Introduction
The Internet of Things (IoT) changes how people interact with technology on a daily basis, through combinations of digital software and physical hardware that range from very simple devices to highly complex systems. Future innovation in this space is likely to come from both familiar forms of professional design and engineering, as well as from non-professional

networks of people "hacking together," rapidly prototyping their own designs, developing and building bespoke inventions and making adaptations to existing technologies [14]. We can already see examples of the latter in the proliferation of Makerspaces and Fab Labs across the globe [20].

*Open Design* [4, 27] refers broadly to the design, development and distribution of products and systems that are enabled through publicly accessible, shared information resources. It suggests alternative models of ownership, production and consumption that align with critical and interventionist approaches to tech production such as commons-based peer-production [4] and remix culture [18], as well as political and philosophical notions such as postcapitalism [21], libertarian socialism/anti-imperialism [5] and communitarianism [24].

Conceptually, open design has the potential to be of value to both professional manufacturers and non-professional makers. However, in order to realize this potential, infrastructure is needed that is sensitive to the needs of both parties. To develop this infrastructure, we require a more in-depth understanding of the kinds of existing relationships between the parties and the ways that they are currently inter-operating and, indeed, the ways in which they are currently resistant to one another. Understanding instances of active resistance or conflict (and the reasoning behind this) could be informative for developing more sensitive and constructive forms of 'inter-operation'.

The objective of this workshop is therefore to bring together diverse perspectives on existing practices of making, and consider how these (and other) kinds of collaborative and individual making might be supported through open design. Our overall aim is to identify the key challenges and opportunities for open design, merging networks of private and professional design and production at the intersection of *making* and *manufacturing*.

## Background

Interest in 'making', maker culture and maker-spaces, within the HCI community has been steadily growing for several years. At present, it is the site of substantial interest, but its scale is broadening such that approaches are diversifying. Recent research, for example, has considered the social role of the maker space [25] and specific cultures of making [19]. Others have reflected upon the different technologies and techniques that enable making [12]. Indeed, the foundational technologies that underpin phenomena such as the IoT are ever-growing; from basic materials such as plastics and alloys to machines that shape them in different ways, to microcontrollers, sensors, actuators, electronic components and so on. Affordable fabrication equipment has enabled not just broader access to professional techniques, it has also enabled non-professionals to fabricate increasingly elaborate objects of their own design. Many laud the empowering potential of technology in this area [2] while others critique the complex power dynamics emerging within this new production landscape, which could support new engagement with making, but it could also result in exploitative relationships [1].

A number of reports [7, 8, 9] have recently provided high level insights into maker culture from the perspective of government and industry. For example, Makermedia's "Impact of the Maker Movement" [9] is a retrospective, which concludes that "*the potential [of*

## Previous Workshops

*The Future of Making: Where Industrial and Personal Fabrication Meet* (Aarhus, Denmark, Aug 2015)

In this workshop, current notions of fabrication were discussed, such as a trend towards unique goods instead of mass produced goods, the debatable ideal of everyone being or becoming a "maker", and how different forms of fabrication relate.

http://projects.hci.sbg.ac.at/fabrication2015/

*Rethinking Technology Innovation: Factories, Fabrication & Design Research* (Salzburg, Austria, Sept 2015)

In this three-day expert summit, various, even conflicting, goals (e.g., democratizing technology, profit orientation) of fabrication were discussed and how they relate to innovation in products, services, and processes.

http://hci.sbg.ac.at/sites/ffdr/

*Fabrication & HCI: Hobbyist Making, Industrial Production, and Beyond* (@CHI2016; San Jose, US, May 2016)

This third event focused on changes in fabrication cultures, as well as how they might affect education, technologies, and – HCI research.

http://hci.sbg.ac.at/sites/chi2016_fabrication/

*the movement] is greater than its current trajectory*" (p30). The American Society for Engineering Education's report from their June 2016 Summit, entitled, *Envisioning the Future of the Maker Movement* [8], calls for "*a more holistic approach*" and a "*deeper Maker community*" (p31). We might ask what is meant by these recommendations? What can we learn from these reports? Whose agendas do they represent and how can we interpret their positions? How can we act upon and/or enable their recommendations? To what extent do these recommendations align with the values and needs of non-professional makers?

*Intersecting Making and Manufacturing*

Relatively little has been said so far about the potential for mutually beneficial interactions between makers, who are often characterized as *non-professional* "hobbyists" or "tinkerers", and *professional makers* such as designers, engineers and industrial manufacturers. Fuchsberger et al argue that there are "*strong links between personal and industrial production*", characterizing these links as "intersections of fabrication" [10]. However, the ways these relationships are formed, develop over time and might be brought to a close are still under-explored in terms of empirical and theoretical research. Work is needed to identify the key challenges presented by these intersections.

One potential obstacle is that, despite their obvious similarities, we often tend to consider *making* as separate cultural practice to that of *manufacturing* (i.e. *professional making*). We need to look more closely at the different ways these worlds intersect and the similarities and differences between them. What are the shared concerns of professional and non-professional makers? What are the potential conflicts, and wherein lies the potential for mutually beneficial interactions? A question we might then be in a better position to ask is how we, as an HCI community, might then support these groups to interact?

*Open Design & HCI*

This workshop builds upon previous workshops by foregrounding the concept of "*open design"*. Open design both *reflects* and *extends* existing discourses within HCI and its potential spans from enabling and empowering publics to uniting insights from the cutting-edge of technological development. Open design suggests a space of opportunities for socio-technical infrastructure that enables and evolves models of de-centralized, modular, commons-based and peer-supported making. How, though, does this concept translate into practice?

In reflecting on the intersection of making and manufacturing through the lens of open design, our aim is to develop an understanding of how a culture of openness defines – and is defined by – makers at all levels; how makers and manufacturers might learn from one another, how design work is – or could be – done in this context and how knowledge sharing happens between different people, perhaps with different agendas and values, at different sites and at different times. We also aim to consider the extent to which *open*, in this context, also means *accessible*.

## Organizers

**David Green** is a senior researcher at Northumbria University, working on the EPSRC-funded "Design Your Own Future" project, exploring connections between communities of professional and non-professional makers. With a background in documentary making, he is a co-founder of Cinehack, who organize DIY

filmmaking workshops and publish blueprints for low-cost media making apparatus. He has participated in and co-organized, several CHI workshops.

**Verena Fuchsberger** is a postdoctoral research fellow at the University of Salzburg. Her research focuses on the agency of human and non-human actors in HCI and Interaction Design, with particular interests in the materiality of interactions in industrial contexts. She has previously explored the (digital and physical) production of goods, specifically at the intersection between industrial and hobbyist fabrication. She co-organized several workshops, for instance, at IDC2011, NordiCHI2012, Critical Alternatives 2015, and CHI2016.

**David Kirk** is Professor of Digital Living at Northumbria University. He has interests in the role of design research in HCI, the development of technologies for domestic spaces and design for Human-Building Interaction. He currently leads the project "Design Your Own Future", linking Makers and Manufacturers. He has organized and run numerous previous CHI workshops.

**Nick Taylor** is a Senior Lecturer in DJCAD at the University of Dundee. His research focuses on the use of technologies to support communities and civic engagement.,He is currently principal investigator on the Hacking for Situated Civic Engagement project, which explores how community hackathons can support grassroots innovation by linking neighbourhoods with maker communities.

**David Chatting** is a Research Associate at Newcastle University's Open Lab, and visiting staff at both the RCA and Goldsmiths' Interaction Research Studio, and has his own design practice. He cofounded the Curiosity Collective a group of makers and artists and dorkbot anglia. His current research concerns the interplay of manufacturers and makers. He has organized and participated in several previous CHI workshops

**Janis Meissner** is a PhD student in Digital Civics at Open Lab, Newcastle University. Utilising theories from feminism and disability rights activism, her research critically explores notions of *empowerment* in politically motivated DIY and making. Based on her previous projects on co-designing with urban knitters (yarnbombers) and people with disabilities and DIY-abilities, she is interested in grassroots perspectives on matters of redistribution and recognition in the interrelation of making and manufacturing.

**Martin Murer** an interaction designer and researcher at the University of Salzburg, focuses on craft and technology. Enthusiastic about taking things apart, Martin works towards a PhD that seeks to explore de-constructive practices (e.g., un-crafting, taking things apart) in the realm of interaction design. He co-organized workshops at TEI (2014, 2015), INTERACT 2015, Critical Alternatives 2015 and CHI2016.

**Manfred Tscheligi** is Professor for HCI & Usability at the University of Salzburg, and head of the business unit Technology Experience at the Austrian Institute of Technology. He leads research projects investigating HCI in industry, e.g., the Christian-Doppler Laboratory "Contextual Interfaces". He has been involved in a range of conference activities (e.g., co-chairing CHI 2004 and HRI 2017 in Vienna, ACE 2007, AUI 2011 in Salzburg) and co-organized several workshops and SIGs (CHI, MobileHCI, AUI, CSCW).

**Silvia Lindtner** is Assistant Professor in the Schools of Information and Art and Design at the University of

**Workshop Plan**

**09:00 – 09:30**
Welcome

**09:30 – 10:30**
Introductions

**10:30 – 11:00**
Coffee Break

**11:00 – 12:30**
Activity 1

**12:30 – 14:00**
Lunch

**14:00 – 15:30**
Activity 2

**15:30 – 15:45**
Coffee Break

**15:45 – 16:45**
Activity 3

**16:45 – 17:15**
Next steps

**17:15**
Close (Drinks / Dinner)

Michigan. She researches, writes and teaches about transnational making and tech entrepreneurship cultures, with a particular focus on their intersections with manufacturing and industry development in China. She co-directs the research hub Hacked Matter, which has brought together researchers, industry, artists, designers, and makers on the topic of make & manufacturing over the last 4 years.

**Pernille Bjørn** is Professor in Computer Supported Cooperative work at the Computer Science Department at University of Copenhagen, Denmark (DIKU). Currently, she is working on finding ways to combine critical design and making as strategies for exploratory prototyping for cooperative system design. She has been involved in multiple conferences activities including program chair for CSCW2016 in San Francisco and sub-committee chair for CHI's CSCW track (2015, 2016, 2017). Currently, she is in the EUSSET steering group, the ACM GROUP steering group, and in the advisory board for JCSCW.

**Andreas Reiter** is a PhD student based in the Horizon Digital Economy Research Centre at the University of Nottingham. He has interests in Design for collaboration in Hacker and Maker Spaces.

## Participants

We hope to bring together a diverse group of researchers, practitioners and different makers and manufacturers with varied knowledge, skills and experiences, to reflect on the challenges of supporting a wide spectrum of making. We hope to attract some participants who have attended the previous related workshops, as well as new participants whose interests are aligned more with open design.

## Pre-Workshop Plans

A website will be used to announce and publicize the workshop. This will include links to social media associated with the workshop. The website will house the call for participation and links to previous workshops, thereby acting as a preliminary resource for participants.

Participants will be recruited via social media and HCI-related mailing lists, including both ACM-sponsored lists (such as SIGCHI) and other lists (e.g. hackademia). We hope to connect with local makers - both hobbyists and those who identify as 'professional makers' - by offering free places to local participants.

Before the workshop, we will ask accepted participants to send us a picture that we will combine (also with images by the organizers) into a collage that will hint at what is to come at the workshop.

## Workshop Structure

The workshop will begin with a round of short introductions from the organizers, followed by a summary of the workshop plan. We will start with a summary of the outcomes of previous related workshops (see "previous workshops", p3). This is intended to provide some background context into recent discussions of this topic and will be used to articulate to the participants the specific aims of the present workshop.

Before the first break, we will schedule a round of short introductions, where participants will have an opportunity to present their work, their interests or a short provocation, illustrated by a "good" that characterizes their work, which participants will be invited to bring to the workshop.

*Activity 1*
Our first activity will take the form of a role-playing game, played simultaneously by small groups of 4-5 participants. The activity is designed to encourage people to empathize with the needs of *either* a 'maker' or a 'manufacturer' in the context of an imagined scenario that calls for various different kinds of interaction between these two groups. The game will be played in an extensible format (such that ideas from participants can be written-into the game as it is played).

As well as being an ice-breaker, the game is also intended to sensitize participants to the topic of open design. It also introduces the concept of scenarios, which will form part of activity 2.

*Activity 2*
Building upon the ideas emerging from activity 1, the first part of this activity will involve the development of fleshed-out scenarios in small groups. These scenarios might derive from participants' own experiences, or they could be fictional (or even futuristic) scenarios. The objective is to consider opportunities for co-operation between makers and manufacturers and discuss how they might be supported through open design. Prompt cards will be used that represent different facets of open design's potential (e.g. social media, Wikipedia, MakerSpaces, Instructables, online learning environments, IoT, etc.)

The second part of this activity will involve an accelerated ideation and design process, with a focus on developing new ways of connecting makers and manufacturers through open design. Our aim is to stimulate and capture the ideas and conversations emerging around the kinds of challenges facing makers across all levels of professionalism. At the end of the activity, each small group will present their ideas back to the rest of the group and the organizers will facilitate a question and answer session.

*Activity 3*
The final activity will take the form of a plenary round-table discussion that seeks to explicitly answer the key question at the heart of the workshop: *"How might open design support productive interactions at the intersection of making and manufacturing?"*

We will document and cluster the key challenges and opportunities for research in this space as they are raised, and this will then be used for poster production (for immediate CHI audience dissemination post workshop) and will be disseminated amongst participants for later reflection (see further plans below).

## Post-Workshop Plans

On the evening of the workshop, we will invite all of the participants to join an informal dinner, where we will be able to carry on the conversations (if desired).

After the workshop, we will make participants' position papers openly available via the website and produce a short blog-post style report as a summary of the workshop. The game developed during activity 1 will also be formalized and made public via the website.

As appropriate, we will use the contacts made amongst the workshop participants to develop a proposal for a special issue of a suitable relevant journal, to which workshop participants will be encouraged to submit developed versions of the position papers.

## Call for Participation

New digital and networked tools, technologies and techniques are placing the means of production in the hands of the many! Not since the Industrial Revolution has there been such active potential for revolutionizing the relationship between Makers and Manufacturers!

Our one-day workshop aims to consider the opportunities for HCI at the intersection of maker culture and professional, industrial manufacturing. In particular, we are interested in exploring how the concept of *open design* could help support productive and equitable interactions between professional *manufacturers* and non-professional *makers*.

We invite submissions from anyone with interests in open design, maker culture, hacking or manufacturing, who feel they would benefit from, or could provide benefit to, discussions about the challenges and opportunities at the intersections and bleeding-edge of making and manufacturing practices.

Applications should be a maximum of 2 pages in the CHI extended abstract format and should include:

- A short biography of the author(s).
- A summary of a piece of recent work that is relevant to the topic of the workshop.

  ***or***

- A provocation that articulates a key challenge relating to open design at the intersection of making and manufacturing.

To apply, please visit http://openmakingworkshop.org

Each submission will be discussed by the organizers and accepted on the basis of relevance and suitability to the workshop theme. One author from each accepted paper should be able to attend the workshop (NB this requires a 1-day conference registration).

## References


1. Morgan G. Ames, Jeffrey Bardzell, Shaowen Bardzell, Silvia Lindtner, David A. Mellis, and Daniela K. Rosner. 2014. Making Cultures: Empowerment, Participation, and Democracy - or Not?. In Proc. CHI EA '14. ACM, 1087–1092. DOI: http://dx.doi.org/10.1145/2559206.2579405
2. Chris Anderson (2013). *Makers: The New Industrial Revolution*. Random House
3. Jeffrey Bardzell, Shaowen Bardzell, and Austin Toombs. 2014. "Now That's Definitely a Proper Hack": Self-made Tools in Hackerspaces. In Proc. CHI '14. ACM, 473–476. DOI: http://dx.doi.org/10.1145/2556288.2557221
4. Yochai Benkler (2006). *The Wealth of Networks: How Social Production Transforms Markets and Freedom*. Yale University Press.
5. Noam Chomsky (2012). *Making the Future: Occupations, Interventions, Empire and Resistance*. City Lights Books.
6. Leon Cruickshank (2014). *Open Design and Innovation*. Gower.
7. Foresight (2013). *The Future of Manufacturing: A New Era of Opportunity and Challenge for the UK* - project report. Government Office for Science and Department for Business, Innovation & Skills. BIS/13/809
8. American Society for Engineering Education (2016). *Envisioning the Future of the Maker Movement: Summit Report, June 2016*. http://bit.ly/28TQJWt
9. Deloitte/Makermedia (2014). *Impact of the Maker Movement*. http://bit.ly/1VZGh2f
10. Verena Fuchsberger, Martin Murer, Manfred Tscheligi, Silvia Lindtner, Shaowen Bardzell, Jeffrey Bardzell, Andreas Reiter, and Pernille Bjorn. 2016.

Fabrication & HCI: Hobbyist Making, Industrial Production, and Beyond. In Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems (CHI EA '16). ACM, New York, NY, USA, 3550-3557. DOI: http://dx.doi.org/10.1145/2851581.2856491

11. Verena Fuchsberger, Silvia Lindtner, Martin Murer, and Manfred Tscheligi. 2015. Rethinking Technology Innovation: Factories, Fabrication & Design Research. (2015). http://hci.sbg.ac.at/ffdr
12. Verena Fuchsberger, Martin Murer, Thomas Meneweger, and Manfred Tscheligi. 2014. Capturing the In-between of Interactive Artifacts and Users: A Materiality-centered Approach. In Proc. NordiCHI '14. ACM, 451–460. DOI:http://dx.doi.org/10.1145/2639189. 2639219
13. Verena Fuchsberger, Martin Murer, Manfred Tscheligi, Silvia Lindtner, Andreas Reiter, Shaowen Bardzell, Jeffrey Bardzell, and Pernille Björn. 2015. The Future of Making: Where Industrial and Personal Fabrication Meet. In Critical Alternatives '15. Aarhus Univ. Press.
14. Mark Hatch (2013) *The Maker Movement Manifesto: Rules for Innovation in the New World of Crafters, Hackers, and Tinkerers*. McGraw-Hill
15. Innovate UK (2013) IoT Challenges and Opportunities http://bit.ly/149oAVd
16. Mike Kuniavsky (2010) *Smart Things: Ubiquitous Computing User Experience Design*. Morgan Kaufmann
17. Stacy Kuznetsov and Eric Paulos (2010) Rise of the Expert Amateur: DIY Projects, Communities, and Cultures. In Proc. ACM CHI. 295-304
18. Lawrence Lessig. (2008) *Remix: Making Art and Commerce Thrive in the Hybrid Economy*, Penguin.
19. Silvia Lindtner. 2015. Hacking with Chinese Characteristics The Promises of the Maker Movement against China's Manufacturing Culture. Science, Technology & Human Values (2015).
20. Silvia Lindtner, Garnet D. Hertz, and Paul Dourish. 2014. Emerging Sites of HCI Innovation: Hackerspaces, Hardware Startups & Incubators. In Proc.CHI '14. ACM, 439–448. DOI: http://dx.doi.org/10.1145/2556288.2557132
21. Paul Mason (2016). *Postcapitalism: A Guide to Our Future.* Macmillan.
22. Angus Montgomery (2012) *Bringing Manufacturing Back*. Design Week. http://bit.ly/1Aow1or
23. David Roedl, Shaowen Bardzell, and Jeffrey Bardzell. 2015. Sustainable Making? Balancing Optimism and Criticism in HCI Discourse. ACM Trans. Comput.-Hum. Interact. 22, 3, Article 15 (June 2015), 27 pages. DOI: http://dx.doi.org/10.1145/2699742
24. Michael J. Sandel (2012). *What Money Can't Buy: The Moral Limits of Markets*. Macmillan.
25. Austin L. Toombs, Shaowen Bardzell, and Jeffrey Bardzell. 2015. The Proper Care and Feeding of Hackerspaces: Care Ethics and Cultures of Making. In Proc. CHI '15. ACM, 629–638. DOI: http://dx.doi.org/10.1145/2702123.2702522
26. Nick Taylor, Ursula Hurley, and Philip Connolly. 2016. Making Community: The Wider Role of Makerspaces in Public Life. In Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (CHI '16). ACM, New York, NY, USA, 1415-1425. DOI: http://dx.doi.org/10.1145/2858036.2858073
27. Bas van Abel, Lucas Evers, Roel Klaassen, and Peter Troxler (eds.). 2011. Open Design Now: Why design cannot remain exclusive. BIS Publishers, Amsterdam.